

Oversight News

Newsletter of the Commonwealth's environmental oversight of the Paducah Gaseous Diffusion Plant

Ditch Cleanup Makes Headway

The Department of Energy (DOE) has taken crucial steps to cut off what for years has been suspected as a leading source of contamination to off-site areas near the Paducah Gaseous Diffusion Plant (PGDP).

The North/South Diversion Ditch (NSDD) historically received a variety of wastewater discharges from the PGDP. This drainage ditch also carried storm water northward from the central portion of the facility, past the plant boundary, and into Little Bayou Creek. Over time, this process exposed the soil in the ditch to trichloroethylene (TCE), polychlorinated biphenyls (PCBs), radionuclides, and various metals. As a result, contaminated sediments migrated beyond plant boundaries by means of surface water transport. To address these issues, DOE, the U.S. Environmental Protection Agency and



Workers removed soil from Section 2 of the North/South Diversion Ditch and placed it into storage bags for waste characterization.

Photo by Brian Begley, Ky. Division of Waste Management

Kentucky signed a Record of Decision in 2002 to remediate the NSDD.

For planning purposes, the ditch was divided into five sections. Sections 1 and 2, located inside the plant security fence, are generally thought to be more contaminated than Sections 3, 4 and 5, which are outside the plant security fence. The two-mile ditch varies from eight feet wide and a half-foot deep inside the fence to 36 feet wide and 15 feet deep outside the fence.

Phase I of the remedial action began in October 2002. DOE contractors installed new aboveground piping to reroute all of the plant's wastewater discharges around the NSDD on their way to treatment lagoons. They constructed a sediment basin in Section 2 of the ditch to collect and treat storm water from the affected area. Finally, they removed culverts that had allowed NSDD storm water to flow beyond the security fence. These steps, completed in the fall of 2003, effectively ended the passage of NSDD contaminants to off-site areas.

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Ditch Cleanup Makes Headway

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During the excavation of Section 2, the removed soil was placed in three-cubic-yard storage bags for waste characterization and disposal. Contractors sampled the bags for contaminants of concern. Sample results were compared to the waste acceptance criteria for the C-746-U landfill to determine if the soil could be disposed there (the waste acceptance criteria include limits on allowable concentrations of contaminants in material slated for disposal at the landfill). Lab results indicated that none of the contaminants exceeded the criteria, and the soil was placed in the C-746-U landfill. Oversight by the Kentucky Division of Waste Management included observing the excavation work and collecting samples from random bags to test for TCE, metals, PCBs and radionuclides.

Ongoing Phase II activities of the remedial action consist of digging out the top four feet of contaminated soil from Section 1 of the NSDD and restoring the excavated area with a layer of clean soil on top of a clay liner.

Prior to excavation of Section 1, in-place soil samples were collected in March of 2004. The results from this sampling, along with analysis of historical data, were again

used to evaluate the suitability of placing remediation waste into the C-746-U landfill. Division personnel conducted split sampling with DOE to obtain confidence that no contaminated soil would be disposed in the landfill. Analytical results from the NSDD soil collected by both DOE and the division indicated that Section 1 soil contaminant levels were below the appropriate waste acceptance criteria.

Excavation of Section 1 began in May 2004. By mid-May, almost 250 feet of the ditch, yielding 1,300 cubic yards of soil, had been excavated and disposed.

Throughout the remedial activity, the division will monitor the excavation. Division personnel will routinely collect samples for lab analysis to ensure that soils do not exceed the waste acceptance criteria levels for C-746-U landfill disposal.

The excavation is expected to continue through September 2004. An estimated 12,500 cubic yards of soil will be removed. Upon completion of work, the division and DOE will conduct post-excavation sampling of the ditch to ensure that no waste exceeding the specified cleanup levels remains.

The division received a draft of DOE's *Sampling and Analysis Plan for Site Investigation and Risk Assessment of the Surface Water Operable Unit (On-Site) at the Paducah Gaseous Diffusion Plant* on April 30, 2004. This document addresses an investigation of Sections 3, 4 and 5 of the NSDD. The division will work with DOE and EPA to develop a plan that thoroughly assesses the nature and extent of contamination in these sections of the ditch. Sampling activities are scheduled to begin in the spring of 2005.



Workers excavated a southern portion of Section 1 of the North/South Diversion Ditch near the center of the Paducah Gaseous Diffusion Plant.

Photo by Jon Maybriar, Ky. Division of Waste Management

The plan for Sections 3, 4 and 5 can be viewed online at www.waste.ky.gov/programs/hw/PGDP+Section by following the links to archived documents for April 2004 and scrolling to the document listed as "SAP of SWOU (4/29/04)."

By Jon Maybriar and Lori Veal, Ky. Division of Waste Management, Hazardous Waste Branch

Full-Scale Use of Direct Heating Proposed

A study to test the viability of using six-phase heating to remove trichloroethylene (TCE) from the subsurface was successful, according to a March 2004 report from the Department of Energy (DOE). A six-phase heating system installed near the southeast corner of the C-400 building was energized on February 4, 2003. When the system ceased operation on September 6, 2003, more than 22,000 pounds of TCE had been removed from the subsurface. Based on the study's outcome, DOE proposes to use similar technology for a full-scale cleanup in the area.

Six-phase heating is an innovative direct-heating technology requiring at least seven subsurface electrodes. Six of the electrodes are installed in a hexagonal array to a desired depth into contaminated soils. As electricity flows between the six hexagonally-arranged electrodes and a seventh, neutral electrode, TCE-contaminated soil and groundwater heat up, which vaporizes the TCE. Vacuum wells extract air containing TCE vapor. This air stream is then treated to remove the TCE (and other volatile organic contaminants) before being discharged to the atmosphere.

For decades, TCE was used in the plant's C-400 equipment cleaning building as a degreasing solvent. Over time, a large mass of the liquid pooled beneath the building. This virtually undiluted mass of TCE is often described as dense non-aqueous phase liquid, or DNAPL (pronounced "D-napple"), because it is denser than and only slightly soluble in water. As it slowly dissolves into surrounding groundwater, TCE DNAPL can act as an ongoing source of aquifer contamination.

The six-phase heating study was designed primarily to test the technology's effectiveness at removing TCE DNAPL under the specific conditions found beneath the C-400 building. Masses of TCE DNAPL exist both in the shallow Upper Continental Recharge System (UCRS)—which consists of clay and silt with some sand and gravel—and in the deeper Regional Gravel Aquifer. The main goal of the study was to show that the technology could boil TCE present in the UCRS layer and the aquifer, thereby enabling its removal from the subsurface using vapor extraction wells.

Prior to system startup, UCRS soil samples collected from the treatment zone indicated that an average TCE concentration of 125,111 parts per billion existed in this portion of the subsurface. Following treatment, a second round of sampling indicated that the average concentration had dropped to 2,493 parts per billion, a fairly significant reduction.

Levels of dissolved TCE were measured in groundwater from the Regional Gravel Aquifer before and after the study. A comparison of pre- and post-test groundwater sample results indicates that the system effectively decreased dissolved TCE concentrations in the treatment zone by 99.1 percent. While this figure doesn't directly indicate the amount of DNAPL removed from the aquifer, it does suggest that enough DNAPL was removed from the treatment zone to have a substantial impact on the levels of dissolved TCE contamination. Within the treated zone, concentrations of dissolved TCE stayed at the reduced level for a month after system shutdown. This also tends to suggest that DNAPL was removed from the treatment zone.

A proposed remedial action plan for the C-400 TCE source areas is available for public review and comment until July 16, 2004. The plan may be viewed on the Kentucky Division of Waste Management's Web site, www.waste.ky.gov/Programs/hw/PGDP+Section, by following the links to archived documents for March 2004 and the "Six-Phase D2." This document outlines a

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The southeast corner of the C-400 building, where DOE proposes to install a direct-heating system to treat TCE contamination. A treatability study of direct heating suggested it has potential for success in the C-400 area.

Photo by Gaye Brewer, Ky. Division of Waste Management

Full-Scale Use of Direct Heating Proposed

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plan to install a full-scale direct heating system at C-400. Any such action taken at C-400 would be considered interim, since it's unlikely that any currently available technology can completely remove all DNAPL from the C-400 site.

However, if the results of the treatability study are any indication, a full-scale deployment of the direct-heating technology should be able to remove a significant amount of DNAPL from what likely is the main source of most of the TCE groundwater contamination emanating from the plant.

By **Todd Mullins**, Ky. Division of Waste Management, Hazardous Waste Branch

Permit up for Re-issuance

In April, the Kentucky Division of Waste Management prepared a draft for the re-issuance of the U.S. Department of Energy/Bechtel Jacobs LLC hazardous waste permit at the Paducah Gaseous Diffusion Plant (PGDP) site. The permit was originally issued to DOE and Martin Marietta Energy Systems Inc. on Aug. 19, 1991. Since that time, the permit has been updated through 15 various modifications. The existing permit allows the PGDP to treat and store hazardous waste and requires post-closure care and maintenance of an inactive (closed) hazardous waste landfill.

In addition to the currently permitted treatment processes, the re-issuance will allow treatment of hazardous waste by macroencapsulation and compaction in existing permitted areas of the facility. The permit reissuance also addresses DOE Material Storage Areas (DMSAs) where newly discovered hazardous wastes were found to be stored in violation of the existing permit.

Also, the re-issuance coordinates the cleanup schedule in the permit with the current cleanup schedule in the Federal Facility Agreement between DOE, the U.S. Environmental Protection Agency and Kentucky. Provisions in the draft re-issuance allow certain changes to interim dates in the cleanup schedule to proceed as minor modifications to the permit.

Oversight Personnel News

Some personnel changes have recently taken place in the Paducah Gaseous Diffusion Plant (PGDP) section of the Hazardous Waste Branch.

Jamie Lowe works for the Hazardous Waste Branch as the PGDP section secretary. Her responsibilities include tracking incoming documents, updating a reading file of outgoing documents, maintaining the file room's large collection of PGDP documents, and many other administrative support tasks for the PGDP section. Jamie holds a degree in occupational therapy assisting from the University of Southern Indiana.

Vicki Voisard also joined the PGDP section as a geologist. She holds a bachelor's degree in geology from Ball State University and has completed coursework there for a master's degree in micropaleontology. Vicki has done extensive environmental field investigation work for the private sector and at the Indiana Department of Natural Resources. Her responsibilities with the PGDP section include oversight of the C-746-K ash landfill and the C-404 hazardous waste landfill.

Lori Veal, who joined the section in August 2003 as an environmental engineer assistant, recently accepted a promotional opportunity to work for the Kentucky Division of Water. Her oversight responsibilities with the PGDP section included storm water control issues, the Department of Energy's hazardous waste management permit, and issues related to the management of depleted uranium hexafluoride cylinders.

The division is currently in the process of responding to the comments received during the public comment period (which took place from April 18 to June 1, 2004). The final version will reflect any changes needed in response to those comments.

The permit and related documents, such as a transcript from a public hearing held on May 25 to accept comments on the draft re-issuance, can be viewed online at the division's Web site, www.waste.ky.gov/Programs/hw/PGDP+Section.

By **Lori Veal**, Ky. Division of Waste Management, Hazardous Waste Branch

Innovative TCE Screening Technology to Be Used

This summer, investigators conducting two separate site investigations at the Paducah Gaseous Diffusion Plant (PGDP) will be using a new tool to help identify moderate to high concentrations of trichloroethylene (TCE) and other associated volatile organic contaminants present underground. The Membrane Interface Probe, or MIP, is a relatively new screening technology that allows investigators to quickly identify subsurface zones where elevated levels of volatile organic contaminants exist. More precise lab testing is then typically used to confirm the probe's findings and to further pinpoint contaminant source zones.

The MIP technology, while innovative, is not overly complex. The MIP is a heated probe that's typically attached to a direct-push drill rig. The probe is pushed into the ground until it reaches the desired sampling depth. At that point, the probe is heated. If volatile organics are present near the probe, they become a gas that passes through a "window" in the probe's side. This window is special, allowing gas, but not water, to pass through it. A sample tube inside the probe transfers the gas up to the surface, where it's analyzed. Depending on the instrumentation used to test the sample, a qualitative to semi-quantitative estimate of the amount of contaminant can be obtained.

The two upcoming site investigations will both employ the MIP to help delineate zones of dissolved-phase and free-phase TCE. Below ground, TCE may exist in two phases: in "free phase," as a mass of liquid organic chemical, or in dissolved phase, after it has dissolved into and contaminated the groundwater. Because it is denser than water, free-phase TCE may also be described as dense non-aqueous phase liquid, or DNAPL.

The two investigations will use the MIP in slightly different ways. A site investigation near the C-746-S and -T landfill will use the probe to help identify dissolved-phase TCE contamination that may be emanating from the landfill area.

An investigation of a groundwater contaminant plume known as the Southwest Plume will focus on detecting both dissolved-phase TCE and free-phase (DNAPL) TCE source zones. Such source zones can act to

continually feed the groundwater contaminant plumes at PGDP. If left unchecked, DNAPL TCE sources can continue to pollute groundwater for hundreds and perhaps thousands of years into the future. It's hoped that using the MIP as a cost-effective screening tool will allow investigators to better delineate DNAPL source zones. Once the location of these zones is known, it becomes possible to treat or remove the DNAPL using available cleanup technologies.

The MIP has been used elsewhere at PGDP—during pre-test sampling at the site of the C-400 six-phase heating treatability study—with promising results. Use of the probe this summer will reveal whether this screening tool can benefit full-scale site investigations.

By Todd Mullins, Ky. Division of Waste Management, Hazardous Waste Branch

Scrap Removal Begins

An estimated 44,000 tons of scrap metal are being removed from nine outdoor storage yards located in the northwest corner of the Paducah Gaseous Diffusion Plant (PGDP). Most of the metal was placed there more than 20 years ago following upgrades to the plant's uranium enrichment equipment.

Sampling indicated that some of the scrap metal had surface contamination of uranium, neptunium, technetium, plutonium and PCBs. Removal of the scrap metal is a priority because it can contribute to surface water contamination. Burial grounds beneath part of the scrap yards will still need to be investigated and remediated.

Work on the project began in late 2002, after completion of a sedimentation basin to capture any contaminated sediment run-off from the scrap yards. Through March 2004, 5,450 tons of scrap metal had been disposed. Scrap metal that satisfied the waste acceptance criteria was disposed in the PGDP's C-746-U Landfill. The scrap metal that did not meet the waste acceptance criteria was shipped to Department of Energy's Nevada Test Site.

The project is expected to continue through mid-2005.

By Gaye Brewer, Ky. Division of Waste Management, Hazardous Waste Branch

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www.waste.ky.gov/programs/hw/PGDP+Section.htm



Retooling Kentucky's Web Site

The Kentucky Division of Waste Management is updating its Web site to make more information related to the Paducah Gaseous Diffusion Plant (PGDP) available to the public online.

Go to www.waste.ky.gov/programs/hw/PGDP+Section.htm for access to documents issued and received by the division. These documents include investigation reports, cleanup plans and other decision documents submitted by the Department of Energy, as well as letters and approvals issued by the division. You can also find copies of public notices and this newsletter. The Web page is updated regularly.

Check www.waste.ky.gov/programs/hw/pgdplinks.htm to find links to other educational Web sites related to the PGDP, environmental cleanup, research, nuclear energy and other topics.

Kentucky Environmental Oversight News is published quarterly by the Kentucky Department for Environmental Protection's Division of Waste Management. It features information regarding environmental cleanup activities at the Paducah Gaseous Diffusion Plant site and related topics. **Free subscriptions** may be requested from Lauren McDonald (newsletter editor), Hazardous Waste Branch, Division of Waste Management, 14 Reilly Road, Frankfort, KY 40601 (502) 564-6716, FAX (502) 564-2705, e-mail Lauren.McDonald@ky.gov.

This newsletter can be provided in alternate formats to anyone with a disability. To request an alternate format, contact Lauren McDonald at the address and phone numbers listed above.

Hearing or speech impaired people can contact the agency by using the Kentucky Relay Service, a toll-free telecommunications device for the deaf (TDD). For voice to TDD, call 1-800-648-6057. TDD to voice: 1-800-646-6056.

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